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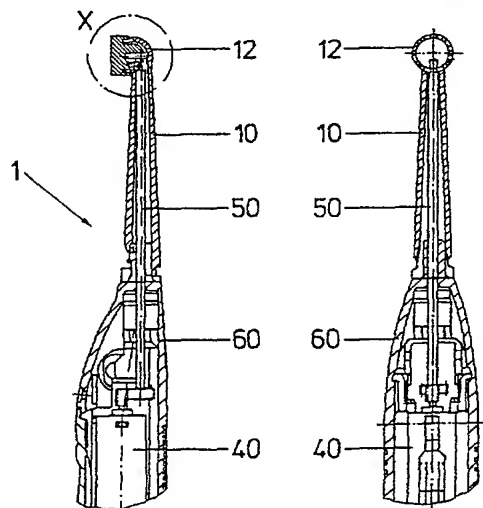
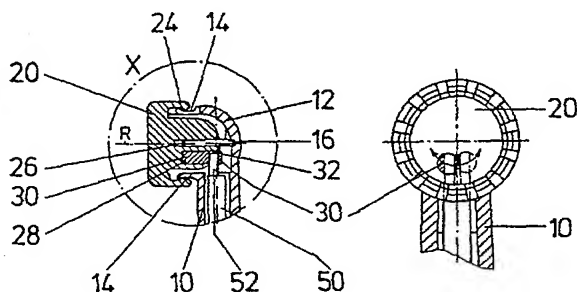
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[Fortsetzung auf der nächsten Seite]

(54) Title: TOOTHBRUSH

(54) Bezeichnung: ZAHNBÜRSTE



(57) Abstract: The invention relates to a toothbrush with a brush head (12) that is supported by a brush body (10) and that is provided with a bristle support (20) that receives the bristles. Said bristle support is rotatably mounted around an axis of rotation (R) and is reversibly driven by an eccentric drive (40, 50, 52). Said eccentric drive (40, 50, 52) is provided with a drive shaft (50) that rotates in one direction. Said shaft is mounted orthogonally to the axis of rotation (R) of the bristle support (20) and extends through the center of the brush body (10). At the front face thereof, an eccentric pin (52) is located. The bristle support (20) is provided with a guide bore or a guide groove (32) that extends in the axial direction and that guides the eccentric pin (52). The bristle support is mounted in the brush head (12) so that it can be axially displaced and is driven on the eccentric drive (40, 50, 52) so as to reversibly reciprocate.

(57) Zusammenfassung: Zahnbürste mit einem von einem Bürstenkörper (10) getragenen Bürstenkopf (12), welcher einen Borsten aufnehmenden Borstenträger (20) aufweist, der um eine Rotationsachse (R) drehbar gelagert und von einem Exzenterantrieb (40, 50, 52) reversierend antreibbar ist, wobei der Exzenterantrieb (40, 50, 52) eine in einer Richtung umlaufende Antriebswelle (50) aufweist, die orthogonal zur Rotationsachse (R) des Borstenträgers (20) und den Bürstenkörper (10) zentral durchsetzend angeordnet ist und die stirnseitig einen Exzenterzapfen (52) trägt. Ferner weist der Borstenträger (20) eine Führungsbohrung oder eine in axialer Richtung verlaufende Führungsnut (32) auf, in der der Exzenterzapfen (52) geführt ist. Darüber hinaus ist der Borstenträger axial verschieblich am Bürstenkopf (12) gelagert und an dem Exzenterantrieb (40, 50, 52) reversierend hin- und herbewegend antreibbar.

WO 01/06947 A1

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(REV. 12-2001)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

WEM-05701

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

10/031886INTERNATIONAL APPLICATION NO.
PCT/EP00/07213INTERNATIONAL FILING DATE
July 27, 2000PRIORITY DATE CLAIMED
July 28, 1999TITLE OF INVENTION
TOOTHBRUSHAPPLICANT(S) FOR DO/EO/US
Martin Niebergall and Udo Goetz

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:
Certificate of Express Mail

U.S. APPLICATION NO. (if known, see 37 CFR 1.53)

INTERNATIONAL APPLICATION NO.

ATTORNEY'S DOCKET NUMBER

107031886

21. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):**

Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO
and International Search Report not prepared by the EPO or JPO..... **\$1040.00**

International preliminary examination fee (37 CFR 1.482) not paid to
USPTO but International Search Report prepared by the EPO or JPO **\$890.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO
but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$740.00**

International preliminary examination fee (37 CFR 1.482) paid to USPTO
but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$710.00**

International preliminary examination fee (37 CFR 1.482) paid to USPTO
and all claims satisfied provisions of PCT Article 33(1)-(4) **\$100.00**

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\$ 890

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30
months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$
Total claims	40 - 20 =	20	x \$18.00	\$ 360
Independent claims	4 - 3 =	1	x \$84.00	\$ 84
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$280.00	\$

TOTAL OF ABOVE CALCULATIONS =

\$ 1334

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above
are reduced by 1/2.

\$

SUBTOTAL =

\$

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30
months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be
accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **\$40.00** per property +

\$ 40

TOTAL FEES ENCLOSED =

\$ 1374

Amount to be
refunded:

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charged:

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- a. ☒ A check in the amount of \$ 1374 to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 501136. A duplicate copy of this sheet is enclosed.
- d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card
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NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR
1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Patent Group
Hutchins, Wheeler & Dittmar
101 Federal Street
Boston, MA 02110

SIGNATURE

Donald W. Muirhead

NAME

33,978

REGISTRATION NUMBER



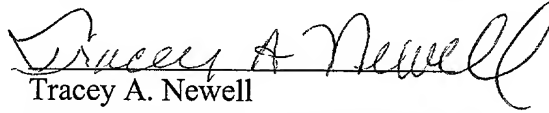
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	:		
Martin Niebergall et al.	:		
	:		
Application No.: To be assigned	:	Art Unit:	To be assigned
	:		
Filed: January 25, 2002	:	Examiner:	To be assigned
	:		
For: TOOTHBRUSH	:	Docket No.:	WEM-05701
	:		
	:		

CERTIFICATE OF EXPRESS MAILING

I hereby certify that the foregoing document is being deposited with the United States Postal Service as Express Mail, postage prepaid, "Post Office to Addressee", in an envelope addressed to: Box PCT, Attn: DO/EO/US, Commissioner of Patents, Washington, DC 20231 on January 25, 2002.


Tracey A. Newell
Express Mail No: EL506926745US

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, entry of this amendment is respectfully requested for the above-captioned U.S. patent application.

Please amend the application as follows:

IN THE SPECIFICATION:

Page 1, line 1, delete the term "Description."

Page 1, line 4, insert the heading --Background of the Invention--.

Page 1, after line 4, insert the heading --1. Technical Field--.

Page 1, please modify the paragraph beginning on line 5 as follows:

The invention relates to a toothbrush with a toothbrush head supported by a toothbrush body [according to the preamble of claim 1].

Page 1, line 7, insert the heading --2. Description of Related Art--.

Page 2, line 6, insert the heading --Summary of the Invention--.

Page 2, please modify the paragraph beginning on line 7 as follows:

[Accordingly the] The invention addresses the problem of improving a toothbrush of the aforescribed type in such a way that it has improved cleaning ability as well as a simple construction.

Page 2, delete the paragraph beginning on line 10.

Page 2, delete the paragraph beginning on line 13.

Page 4, line 21, insert the heading --Brief Description of the Drawings--.

Page 5, line 1, insert the heading --Detailed Description of Various Embodiments--.

Please delete pages 9, 10, and 11 in their entirety.

Please replace line 1 on page 14, with --Abstract of Disclosure--.

Please amend the paragraph beginning on line 5 of page 14 as follows:

A toothbrush is disclosed which has a toothbrush head [(12)] supported by a toothbrush body [(12)]. The toothbrush head [(12)] has a bristle carrier [(20)] which receives the bristles and is pivotally supported for pivoting about a pivot axis [(R)] and can be reversibly driven by an eccentric drive [(40, 50, 52)]. The eccentric drive [(40, 50, 52)] has a drive shaft [(50)] which rotates in one direction, wherein the drive shaft [(50)] extends perpendicular to the pivot axis [(R)] of the bristle carrier [(20)] and penetrates the toothbrush body [(10)] in the center. The end face of the drive shaft [(50)] has an eccentric pin [(52)]. The bristle carrier [(20)] also includes a guide bore or a guide channel [(32)] extending in an axial direction, with the eccentric pin [(52)] being guided in the guide bore or guide channel. The bristle carrier is also supported on toothbrush head [(12)] for axial displacement and can be reversibly driven backward and forward by the eccentric drive [(40, 50, 52)].

A clean copy of the amended paragraphs is attached hereto.

IN THE CLAIMS:

Please amend claims 1-12 as follows:

1 . Toothbrush with a toothbrush head [(312; 412; 512; 612)] supported by a toothbrush body [(310; 410; 510; 610)], the toothbrush head [(312; 412; 512; 612)] comprising:

a bristle carrying bristle carrier [(320; 420; 520; 620)], the bristle carrier [(20; 220; 320; 420; 520; 620)] rotatably supported for rotating about a rotation axis and adapted to be reversibly rotatably driven by an eccentric drive [(50, 52)], wherein the eccentric drive has a drive shaft [(50)] rotating in one direction and arranged perpendicular to the rotation axis [(R)] of the bristle carrier [(320; 420; 520; 620)] and centrally extending through the toothbrush body [(310; 410; 510; 610)], with an end face of the drive shaft [(50)] having an eccentric pin [(52)], wherein the bristle carrier [(320; 420; 520; 620)] has a guide bore or a guide channel [(328, 428; 528; 628)] extending in the axial direction, with the eccentric pin [(52)] guided in the guide bore or said guide channel, [characterized in that] wherein the bristle carrier [(320; 420; 520; 620)] is supported on the toothbrush head [(312; 412; 512, 612)] for movement in the axial direction and adapted to be reversibly driven by the eccentric drive [(40, 50, 52)] so as to move backward and forward along a linear path, [that] wherein the bristle carrier [(320; 420; 520; 620)] has at least one drive pin channel [(324; 424; 524; 624)] which is disposed along a circumferential segment of the bristle carrier [(320; 420; 520; 620)] and inclined in the axial direction, and [that the] wherein at least one drive pin [(314; 414; 514; 614)] which is guided in the drive pin channel [(324; 424; 524; 624)], is disposed on the toothbrush head [(312; 412; 512; 614)].

2. The toothbrush according to claim 1, [characterized in] wherein [that the] two diametrically opposed guide pins [(314)] are disposed on the toothbrush head [(310)].
3. The toothbrush according to claim 1, wherein [or 2, characterized in that] the guide channel [(628)] is formed directly on the bristle carrier [(620)].
4. The toothbrush according to claim 1, wherein [or 2, characterized in that] the guide channel is part of a sliding block which is axially affixed to the bristle carrier.
5. The toothbrush according to claim 1, wherein [or 2, characterized in that] a sliding block [(330; 430; 530)] is supported for axial displacement in the guide channel [(328; 428; 528)], and [that] said sliding block [(330; 430; 530)] has a drive-pin bore [(332; 432; 532)] adapted to engage with the eccentric pin [(52)].
6. The toothbrush according to claim 4, wherein [or 5, characterized in that] the sliding block [(330; 430)] has a cylindrical shape.
7. The toothbrush according to claim 4, wherein [or 5, characterized in that] the sliding block [(530)] has a spherical shape.

8. Toothbrush with a toothbrush head [(12; 212)] supported by a toothbrush body [(10; 210)], the toothbrush head [(12; 212)] comprising:

a bristle carrying bristle carrier [(20; 220)], the bristle carrier [(20; 220)] rotatably supported for rotating about a rotation axis [(R)] and adapted to be reversibly rotatably driven by an eccentric drive [(40, 50, 52)], wherein the eccentric drive has a drive shaft [(50)] rotating in one direction and arranged perpendicular to the rotation axis [(R)] of the bristle carrier [(20; 220)] and centrally extending through the toothbrush body [(10, 210)], with an end face of the drive shaft [(50)] having an eccentric pin [(52)], wherein the bristle carrier [(20; 220)] has a guide bore or a guide channel [(28; 228)] extending in the axial direction, with the eccentric pin [(52)] guided in the guide bore or guide channel, [characterized in that] wherein the bristle carrier [(20; 220)] is supported on the toothbrush head [(12; 212)] for movement in the axial direction and adapted to be reversibly driven by the eccentric drive [(40, 50, 52)] so as to move backward and forward along a linear path, [that] and the eccentric pin [(52)] engages in a drive-pin bore [(32; 232)] or a guide channel [(28; 228)], and is mounted axially fixed in the drive-pin bore [(32; 232)] or is axially moveable in the guide channel [(28, 228)] between limit stops.

9. The toothbrush according to claim 8, [thereby characterized, that] wherein the toothbrush head [(12; 212)] has at least one bearing channel [(14; 214)] adapted to engage with at least one corresponding bearing projection [(24; 224)] which limits the backward and forward linear motion (stroke) of the bristle carrier [(20; 220)].

10. The toothbrush according to claim 8, wherein [or 9, characterized in that] a sliding block [(30; 230)] is provided which includes a drive-pin bore [(32; 232)] or a guide channel adapted to engage with the eccentric pin [(52)], and [that] wherein the sliding block [(30; 230)] is axially affixed in the guide channel [(28; 228)] or axially moveable therein between limit [stop] stops.

11. The toothbrush according to claim 10, [characterized in that] wherein the sliding block [(130; 230; 330; 430)] has a cylindrical shape.

12. The toothbrush according to claim 10, [characterized in that] wherein the sliding block [(530)] has a spherical shape.

A clean copy of the amended claims is attached hereto.

Please add the following claims 13-40:

13. The toothbrush according to claim 2, wherein the guide channel is formed directly on the bristle carrier.

14. The toothbrush according to claim 2, wherein the guide channel is part of a sliding block which is axially affixed to the bristle carrier.

15. The toothbrush according to claim 2, wherein a sliding block is supported for axial displacement in the guide channel, and the sliding block has a drive-pin bore adapted to engage with the eccentric pin.
16. The toothbrush according to claim 14, wherein the sliding block has a cylindrical shape.
17. The toothbrush according to claim 5, wherein the sliding block has a cylindrical shape.
18. The toothbrush according to claim 15, wherein the sliding block has a cylindrical shape.
19. The toothbrush according to claim 14, wherein the sliding block has a spherical shape.
20. The toothbrush according to claim 5, wherein the sliding block has a spherical shape.
21. The toothbrush according to claim 15, wherein the sliding block has a spherical shape.
22. The toothbrush according to claim 9, wherein a sliding block is provided which includes a drive-pin bore or a guide channel adapted to engage with the eccentric pin, and wherein the sliding block is axially affixed in the guide channel or axially moveable therein between limit stops.
23. The toothbrush according to claim 22, wherein the sliding block has a cylindrical shape.

24. The toothbrush according to claim 22, wherein the sliding block has a spherical shape
25. A toothbrush, comprising:
- a body;
 - a head supported by the body;
 - a bristle carrier coupled to the head; and
 - a motor coupled to the bristle carrier, wherein the motor causes the bristle carrier to reversibly rotate about a rotation axis while oscillating axially.
26. The toothbrush according to claim 25, wherein the axial oscillation is longitudinal.
27. The toothbrush according to claim 25, wherein the axial oscillation is vertical.
28. The toothbrush according to claim 25, wherein the motor is coupled to the bristle carrier by a drive shaft, said drive shaft having an eccentric pin.
29. The toothbrush according to claim 28, wherein the toothbrush head includes a circumferential bearing channel and a bearing journal disposed on said toothbrush head.
30. The toothbrush according to claim 29, wherein the bristle carrier includes a bearing bore that engages said bearing journal, at least one bearing projection that engages said bearing channel, and a recess extending in the axial direction.

31. The toothbrush according to claim 30, wherein the toothbrush head includes a sliding block having a guide channel that engages the eccentric pin, said sliding block being inserted in said recess of said bristle carrier.
32. The toothbrush according to claim 29, wherein the toothbrush head includes two diametrically opposed, radially inwardly-facing drive pins inserted on the toothbrush head, said drive pins being inclined in the axial direction.
33. The toothbrush according to claim 32, wherein the bristle carrier includes two drive channels disposed along a circumferential segment of said bristle carrier.
34. The toothbrush according to claim 29, wherein the toothbrush head includes a drive pin and a corresponding drive channel.
35. The toothbrush according to claim 31, wherein the sliding block has a cylindrical shape.
36. The toothbrush according to claim 31, wherein the sliding block has a spherical shape.
37. The toothbrush according to claim 30, wherein the bristle carrier further includes a guide channel that engages the eccentric pin.

38. A method for operating a mechanical toothbrush, comprising:

reversibly rotating a bristle carrier attached to a toothbrush head of the mechanical toothbrush, and

while reversibly rotating the bristle carrier, simultaneously oscillating the bristle carrier in an axial direction.

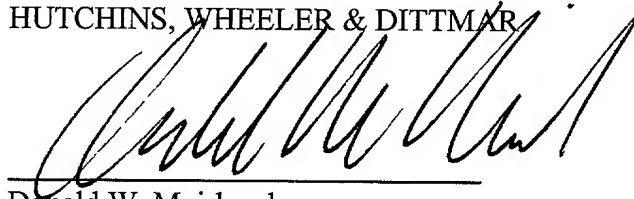
39. The method for operating a mechanical toothbrush according to claim 38, wherein rotating the bristle carrier while simultaneously oscillating the bristle carrier in an axial direction uses a motor coupled to a drive shaft having an eccentric pin that engages the bristle carrier.

40. The method for operating a mechanical toothbrush according to claim 38, wherein rotating the bristle carrier while simultaneously oscillating the bristle carrier in an axial direction uses a motor coupled to a drive shaft having an eccentric pin that engages a sliding block and wherein the sliding block engages the bristle carrier.

REMARKS

Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-951-6676.

Respectfully submitted,
HUTCHINS, WHEELER & DITTMAR



Donald W. Muirhead
Registration No. 33,978

Date: January 25, 2002

Patent Group
Hutchins, Wheeler & Dittmar
101 Federal Street
Boston, MA 02110-1804

Clean Copy of Amended Specification Paragraphs

Page 1, the paragraph beginning on line 5 should read:

The invention relates to a toothbrush with a toothbrush head supported by a toothbrush body.

Page 2, the paragraph beginning on line 7 should read:

The invention addresses the problem of improving a toothbrush of the
aforescribed type in such a way that it has improved cleaning ability as well as a simple
construction.

Page 6, the paragraph beginning on line 18 should read:

The bristle carrier 220 includes an axial guide channel 238 in which a sliding
block 230 is inserted. The sliding block 230 is fixed in the axial direction relative to the
bristle carrier 220. In addition, the sliding block 230 has a drive-pin bore 232 adapted to
engage with an eccentric pin 52 of a drive shaft 50.

Page 14, line 1 should read: Abstract of Disclosure

Page 14, the paragraph beginning on line 5 should read:

A toothbrush is disclosed which has a toothbrush head supported by a toothbrush body. The toothbrush head has a bristle carrier which receives the bristles and is pivotally supported for pivoting about a pivot axis and can be reversibly driven by an eccentric drive. The eccentric drive has a drive shaft which rotates in one direction, wherein the drive shaft extends perpendicular to the pivot axis of the bristle carrier and penetrates the toothbrush body in the center. The end face of the drive shaft has an eccentric pin. The bristle carrier also includes a guide bore or a guide channel extending in an axial direction, with the eccentric pin being guided in the guide bore or guide channel. The bristle carrier is also supported on toothbrush head for axial displacement and can be reversibly driven backward and forward by the eccentric drive.

Clean Copy of Amended Claims

1 . Toothbrush with a toothbrush head supported by a toothbrush body; the toothbrush head comprising:

a bristle carrying bristle carrier, the bristle carrier rotatably supported for rotating about a rotation axis and adapted to be reversibly rotatably driven by an eccentric drive, wherein the eccentric drive has a drive shaft rotating in one direction and arranged perpendicular to the rotation axis of the bristle carrier and centrally extending through the toothbrush body, with an end face of the drive shaft having an eccentric pin, wherein the bristle carrier, has a guide bore or a guide channel extending in the axial direction, with the eccentric pin guided in the guide bore or said guide channel, wherein the bristle carrier is supported on the toothbrush head for movement in the axial direction and adapted to be reversibly driven by the eccentric drive so as to move backward and forward along a linear path, wherein the bristle carrier, has at least one drive pin channel which is disposed along a circumferential segment of the bristle carrier, and inclined in the axial direction, and wherein at least one drive pin which is guided in the drive pin channel, is disposed on the toothbrush head.

2. The toothbrush according to claim 1, wherein two diametrically opposed guide pins are disposed on the toothbrush head.

3. The toothbrush according to claim 1, wherein the guide channel is formed directly on the bristle carrier.

4. The toothbrush according to claim 1, wherein the guide channel is part of a sliding block which is axially affixed to the bristle carrier.
5. The toothbrush according to claim 1, wherein a sliding block is supported for axial displacement in the guide channel, and said sliding block has a drive-pin bore adapted to engage with the eccentric pin.
6. The toothbrush according to claim 4, wherein the sliding block has a cylindrical shape.
7. The toothbrush according to claim 4, wherein the sliding block has a spherical shape.

8. Toothbrush with a toothbrush head supported by a toothbrush body, the toothbrush head comprising:

a bristle carrying bristle carrier, the bristle carrier rotatably supported for rotating about a rotation axis and adapted to be reversibly rotatably driven by an eccentric drive, wherein the eccentric drive has a drive shaft rotating in one direction and arranged perpendicular to the rotation axis of the bristle carrier and centrally extending through the toothbrush body, with an end face of the drive shaft having an eccentric pin, wherein the bristle carrier has a guide bore or a guide channel extending in the axial direction, with the eccentric pin guided in the guide bore or guide channel, wherein the bristle carrier is supported on the toothbrush head, for movement in the axial direction and adapted to be reversibly driven by the eccentric drive, so as to move backward and forward along a linear path, and the eccentric pin engages in a drive-pin bore or a guide channel, and is mounted axially fixed in the drive-pin bore or is axially moveable in the guide channel between limit stops.

9. The toothbrush according to claim 8, wherein the toothbrush head has at least one bearing channel adapted to engage with at least one corresponding bearing projection; which limits the backward and forward linear motion (stroke) of the bristle carrier.

10. The toothbrush according to claim 8, wherein a sliding block is provided which includes a drive-pin bore or a guide channel adapted to engage with the eccentric pin, and wherein the sliding block is axially affixed in the guide channel or axially moveable therein between limit stops.

11. The toothbrush according to claim 10, wherein the sliding block has a cylindrical shape.
12. The toothbrush according to claim 10, wherein the sliding block has a spherical shape.

11. The toothbrush according to claim 10, wherein the sliding block has a cylindrical shape.

12. The toothbrush according to claim 10, wherein the sliding block has a spherical shape.

6/pst

Description

Toothbrush

- 5 The invention relates to a toothbrush with a toothbrush head supported by a toothbrush body according to the preamble of claim 1.

Many types of eccentrically driven toothbrushes with different designs are commercially available.

- 10 Such toothbrushes typically have a toothbrush head that is supported by a toothbrush body and interchangeably attached to an electrical hand tool. The toothbrush head has a bristle carrier which receives the bristles and is pivotally supported for pivoting about a pivot axis. The toothbrush head can be reversibly pivotally driven by an eccentric drive and pivots alternatingly in two pivot directions with a specified pivot angle of, for example, 130 degrees.

- 15 In a commercially available and widely used toothbrush, the eccentric motion is produced by an eccentric gear arranged after the drive motor. The eccentric gear produces a reversing stroke motion which is transferred to a drive pin. The drive pin penetrates the toothbrush body, wherein the angled end of the drive pin which extends in the axial direction with respect to the pivot axis of the bristle carrier, engages in a corresponding bore located on the bristle carrier. The drive-pin bore is here radially offset from the pivot axis. In this way, the reversing stroke action of the lifting rod is transformed into a reversing pivot motion of the bristle body. Such eccentric drives for toothbrushes are described, for example, in the publications U.S. 5,617,601 or U.S. 5,524,312.

- 25 Another variation of an eccentric drive for toothbrushes is described in WO 96/37 164. In this variation, the circular rotary motion of the drive motor is transmitted directly to a drive shaft which penetrates the toothbrush body and has an angled end. The angled end engages with a corresponding guide channel located on the bristle carrier, thereby inducing a reversing pivot motion in the bristle carrier. This arrangement produces a mechanically very simple and wear-resistant drive. This type of drive also requires very little space, so that the housing can have a slim and compact form.

- 30 Although a reversibly driven toothbrush of this type operates reliably, it does have several disadvantages. In particular, the tooth cleaning ability of such a toothbrush still needs to be improved.

It is also known to improve the tooth cleaning ability by superimposing an additional motion on the

rotation motion. For example, WO 96/31171 or DE 44 33 914 A1 describe toothbrushes of this type with an eccentric drive, wherein the bristle carrier executes a sort of pivoting motion.

It has been demonstrated, however, that such toothbrush is still unable to clean teeth optimally

5 Moreover, the toothbrush is mechanically complex.

Accordingly, the invention addresses the problem of improving a toothbrush of the aforescribed type in such a way that it has an improved cleaning ability as well as a simple construction.

10 The stated problem is solved with a toothbrush of the aforescribed type by the characterizing features of claim 1.

Advantageous embodiments of the invention are described in the characterizing features of the dependent claims.

15

The invention relies on the concept of supporting the bristle carrier for axial displacement on the toothbrush head and to drive the bristle carrier with the eccentric drive reversibly backward and forward along a linear path. This impresses on the bristle carrier an oscillating axial displacement motion which results in an excellent tooth cleaning ability.

20

According to a first embodiment, the toothbrush head has at least one bearing channel adapted to engage with at least one corresponding bearing projection. This embodiment employs limit stops that limit the linear travel path of the backward and forward motion (stroke) of the bristle carrier.

25

According to a second embodiment, the axial linear travel can be directly impressed on the bristle carrier. For this purpose, a sliding block can be affixed in the axial direction in the guide channel of the bristle carrier; alternatively, the sliding block can be moveable in the axial direction between limit stops. The sliding block also has a drive-pin bore or a guide channel, with the eccentric pin engaging in the guide channel. The bristle carrier is supported on the toothbrush head for axial displacement so as to positively follow the corresponding motion of the eccentric pin in the axial direction between the two reversing points. Accordingly, as described above, an axial displacement motion is superimposed on the rotation motion.

30

35 According to additional embodiments, the superimposed axial displacement motion can also be produced by providing the bristle carrier with at least one drive-pin channel which is disposed along a circumferential segment of the bristle carrier and inclined in the axial direction. The

toothbrush head has a corresponding drive pin adapted to engage with the drive-pin channel. A rotary motion is thereby positively transmitted to the bristle body to produce an axial displacement motion, since the drive-pin channel has an axial component. This arrangement provides an additional simple mechanical link guide proximate to the circumference of the bristle carrier. It is
 5 sufficient to provide a single drive pin and correspondingly a single drive-pin channel, wherein the arrangement of drive pin and drive-pin channel can be interchanged.

Alternatively, two diametrically opposed drive pins can be arranged on the toothbrush head. This arrangement reduces the stress on the drive pins and on the channel, since now two link guides
 10 produce the axial force.

According to a fifth embodiment, the guide channel can be formed directly in the bristle carrier. The eccentric pin directly engages the guide channel and thereby moves backwards and forwards between a front and a rear reversing point. A force can thereby be transmitted via the
 15 sides of the guide channel extending in the axial direction, thereby reversibly driving the bristle carrier.

This embodiment operates very quiet due to the small number of moveable parts and is suited in particular for high-frequency applications, i.e., so-called fast-running toothbrushes which are commonly referred to as "ultrasonic" toothbrushes. The eccentric shaft of such toothbrushes rotates with the rotation speed in the range between 15,000 and 25,000 revolutions per minute. At such high rotation speeds, the components are subjected to particularly high stress which is amplified by the continuous reversal of the rotation direction of the toothbrush body. It is therefore important to construct the toothbrush in the simplest possible fashion, as implemented
 20 to a great extent by the aforescribed measures.

The proposed construction does not require additional constructive measures to impress on the bristle carrier the axial displacement motion in addition to the oscillatory pivoting motion. This combination results in the excellent tooth cleaning ability mentioned above. For this purpose, the
 30 length of the guide channel in the axial direction is smaller than the travel path between the front and the rear reversing points of the eccentric pin.

The travel of the eccentric pin is bounded by the limited length of the guide channel in the axial direction. The bristle carrier is supported for axial displacement on the toothbrush head so as to positively execute in the axial direction the corresponding motion of the eccentric pin between the
 35 two reversing points. This causes an axial displacement motion to be superimposed on the rotation motion.

According to a sixth embodiment, a sliding block is affixed in the axial direction on the bristle carrier. The sliding block has a guide channel adapted to engage with the eccentric pin which can move backward and forward in the axial direction between a front and a rear reversing point.

5

According to a seventh embodiment, the sliding block is supported in the guide channel for axial displacement. The sliding block has a drive-pin bore adapted to engage with the eccentric pin. The eccentric pin thereby guides the sliding block backward and forward between a front and a rear reversing points inside the guide channel integrated in the bristle carrier.

10

All embodiments with a sliding block have in common that the sliding block and the corresponding recess or guide channel, respectively, disposed on the bristle carrier are formed so as to enable a rotation or pivoting motion of the sliding block which opposes the pivot motion of the bristle body, so that the eccentric pin engaging with the recess or guide channel is not subjected to bending stress.

15

The sliding blocks typically have a cylindrical shape, thereby providing a reliable support in the recess and guide channel, respectively. According to a preferred embodiment, the sliding block can also have a spherical shape. This embodiment advantageously minimizes the friction forces produced between the sliding block and the recess or the guide channel, respectively.

20

The invention will now be described in more detail with reference to the embodiments illustrated in the drawings. It is shown in:

25 Fig. 1 a cross-sectional view of a drive according to a first embodiment;

Fig. 2 an enlarged cross-sectional view (detail) of a drive according to Fig. 1;

Fig. 3 an enlarged cross-sectional view of a drive according to a second embodiment;

30

Fig. 4 an enlarged cross-sectional view of a drive according to a third embodiment;

Fig. 5 an enlarged cross-sectional view of a drive according to a fourth embodiment; and

35 Fig. 6 an enlarged cross-sectional view of a drive according to a fifth embodiment.

The first embodiment of a toothbrush 1 is depicted in Fig. 1.

A toothbrush head 12 forms a component of a toothbrush body 10 which can be interchangeably connected to a handle portion 60. A bearing journal 16 which engages with a corresponding bearing bore 26 of a bristle carrier 20 is disposed on the toothbrush head 12. The bearing journal 16 therefore represents the rotary/pivot bearing for the bristle carrier 20.

5

The toothbrush head 12 also includes a circumferential bearing channel 14 adapted to engage with a corresponding bearing projection 24 of the bristle carrier 20. As a result, the axial travel path of the bristle carrier 20 with respect to the toothbrush head 12 is limited, which prevents the bristle carrier 20 from becoming detached. The bristle carrier 20 includes a recess 28 extending
10 in the axial direction, with a sliding block 30 having a guide channel 32 being inserted in the recess 28. The axial position of the sliding block 30 is defined with respect to the recess 28 and the bristle carrier 20, respectively.

An eccentric pin 52 of a drive shaft 50 engages in the guide channel 32, which in the given
15 example is in form of a bore. However, the guide channel 32 can also extend in the axial direction. The drive shaft 50 is rotatably driven by a motor 40.

Accordingly, the bristle carrier 20 moves in the following fashion:

20 As seen more particularly from the enlarged diagram X of Fig. 1, the eccentric pin 52 in the exemplary cross-sectional view is located at the left reversing point. When the rotation starts, the position of the eccentric pin 52 moves to the right, until the eccentric pin 52 reaches a right reversing point.

The toothbrush head 20 thereby executes the pivoting motion indicated in the top right corner of
25 the partial view, namely starting from the left end position indicated by the solid line to the right end position indicated by the dashed line. When the pivoting motion continues, the eccentric pin 52 returns to its initial position, with the toothbrush body 20 executing a pivoting motion in the opposite direction.

30 The motion can only be performed reliably if the eccentric pin 52 is laterally guided with a relatively small clearance, so that the pivotal motion can be transformed substantially without play. In addition, the sliding block 30 has to be supported in the recess 28 so as to be able to pivot about its longitudinal axis in the opposite direction of the rotation of the bristle carrier 20 to compensate for the motion of the bristle carrier 20, in order to prevent bending stress on the
35 engaging eccentric pin 52. The sliding block 30 and the recess 28 have a matching circular cross-section to enable an essentially play-free compensating motion without noticeable friction. It should also be noted that the length of the eccentric pin 52 is selected so that it always

engages the sliding block 30 regardless of the actual position of the sliding block 30.

With this simple mechanical arrangement, the continuous rotary motion of the drive shaft 50 can be transformed into a reversing rotary motion (pivoting motion).

5

Fig. 2 is an enlarged view of the toothbrush according to Fig. 1. The following detailed features can be seen in Fig. 2:

An upper end of a toothbrush body 210 has a toothbrush head 212 with a bearing journal 216.

10 The bearing journal 216 receives a bristle carrier 220 on a bearing bore 226.

The bristle carrier 220 is supported for axial displacement relative to the toothbrush head 212. A circumferential bearing projection 224 engages with a bearing channel 214 on the toothbrush head 212, wherein the bearing channel 214 is constructed so that the bristle carrier 220 can
15 travel between a forward axial position, shown in Fig. 2 on the left, and a rearward axial position, shown in Fig. 2 on the right. The maximum travel path is referred to as "stroke."

The bristle carrier 220 includes an axial guide channel 228 in which a sliding block 230 is inserted. The sliding block 230 is fixed in the axial direction relative to the bristle carrier 220. In
20 addition, the sliding block 230 has a drive-pin bore 232 adapted to engage with an eccentric pin 52 of a drive shaft 50.

Since the eccentric pin 52 is positively coupled with the bristle carrier 220 in the axial direction via the sliding block 230, the bristle carrier 220 executes an axial linear motion which is
25 superimposed on the rotation motion. This high-frequency pulsating motion in the axial direction significantly improves the cleaning result. This observation can therefore be implemented by simple mechanical means, as discussed with reference to the aforescribed embodiment.

Fig. 3 shows a toothbrush 300 in which an axial linear motion of a bristle carrier 320 is also
30 implemented by a positive coupling.

Again, a toothbrush body 310 with a toothbrush head 312 and a bearing journal 316 is provided. The bearing journal 316 receives the bristle carrier 320 for axial displacement in a bearing bore 326.

35

The bristle carrier 320 includes an axial guide channel 328 in which an axially moveable sliding block 330 is inserted. The sliding block 330 has a drive-pin bore 332 adapted to engage with an

eccentric pin 52 of a drive shaft 50.

In addition, two diametrically opposed, radially inwardly-facing drive pins 314 are inserted on the toothbrush head 312. The drive pins 314 engage with two corresponding drive channels 324 disposed along a circumferential segment of the bristle carrier 320. The drive pins 314 are slightly inclined in the axial direction, so that a rotation motion of the bristle carrier 320 causes a positively coupled axial displacement motion.

The toothbrush 400 depicted in Fig. 4 is implemented essentially identical to the aforescribed embodiments.

Again, a toothbrush body 410 has a toothbrush head 412 with a bearing journal 416. The bristle carrier 420 is supported for longitudinal displacement on the bearing journal 416 by a bearing bore 426.

The bristle carrier 420 has an axial guide channel 428 in which a sliding block 430 is supported for axial displacement. The sliding block 430 has a drive-pin bore 432 adapted to engage with an eccentric pin 52 of a drive shaft 50.

So far, this embodiment is identical to the embodiment described with reference to Fig. 3, except for the fact that only one drive pin 414 is provided which cooperates with a drive channel 424. The axial linear motion is produced by having a drive channel 424 which is slightly inclined in the axial direction, thereby defining the axial stroke of the bristle carrier 420.

The only difference between the embodiment of a toothbrush 500 depicted in Fig. 5 and the previously described embodiments is that a sliding block 530 has a spherical shape. The sliding block 53 has a drive-pin bore 532 adapted to engage with an eccentric pin 52 of a drive shaft 50.

The sliding block is guided for axial displacement in an axial guide channel 528 of a bristle carrier 520. The bristle carrier 520 has a bearing bore 526 which guides the bristle carrier 520 on a bearing journal 516 for longitudinal displacement. The bearing journal 516 is attached to a toothbrush head 512 of a toothbrush body 510.

A drive pin 514 is disposed on the toothbrush head 512, wherein the drive pin 514 cooperates with a corresponding drive channel 524 in such a way that a pivoting motion of the bristle body 520 causes a positively-coupled axial stroke of the bristle body 520.

The embodiment of the toothbrush 600 illustrated in Fig. 6 is essentially identical to the embodiments depicted in Figs. 4 and 5.

5 Again, a toothbrush body 610 with a toothbrush head 612 is illustrated, wherein the toothbrush head 612 has a bearing journal 616. The bristle carrier 620 is supported for longitudinal displacement on the bearing journal 616 via a bearing bore 626.

As shown in detail in Figs. 4 and 5, a drive pin 614 cooperates with a drive channel 624 which is slightly inclined in the axial direction. This produces the axial stroke of the bristle carrier 620.

10

So far, the basic construction of the illustrated embodiment of the toothbrush is identical to that described with reference to the embodiments of Figs. 4 and 5, except for the fact that in the embodiment of a toothbrush 600 depicted in Fig. 6 the guide channel 628 is formed directly in the bristle carrier 620.

15

The eccentric pin 52 which can be set in rotation by the drive shaft 50 which is in turn driven by a motor, engages directly with the guide channel 628. The motor drive operating on the drive shaft 50 causes the eccentric pin 52 to move freely backward and forward in the guide channel 628 between a front and a rear reversing point. The eccentric pin 52 transmits a force to the bristle carrier 620 via the sides of the guide channel 628 which extend in the axial direction. To eliminate bending stress in the eccentric pin 52 which engages in the guide channel 628, the guide channel 628 has a cavity 634 extending inwardly in the radial direction, with the cavity 634 receiving the free end of the eccentric pin 52, with a space being formed between the free end and the inner wall of the cavity 634.

20

List of reference numerals

	1	toothbrush
	10	toothbrush body
5	12	toothbrush head
	14	bearing channel
	16	bearing journal
	20	bristle carrier
	24	bearing projection
10	26	bearing bore
	28	recess
	30	sliding block
	32	guide channel
	40	motor
15	50	drive shaft
	52	eccentric pin
	60	handle
	200	toothbrush
20	210	toothbrush body
	212	toothbrush head
	214	bearing channel
	216	bearing journal
	220	bristle carrier
25	224	bearing projection
	226	bearing bore
	228	guide channel
	230	sliding block
	232	drive-pin bore
30		
	300	toothbrush
	310	toothbrush body
	312	toothbrush head
	314	drive pin
35	316	bearing journal
	320	bristle carrier
	324	drive-pin channel

	326	bearing bore
	328	guide channel
	330	sliding block
	332	drive-pin bore
5		
	400	toothbrush
	410	toothbrush body
	412	toothbrush head
	414	drive pin
10	416	bearing journal
	420	bristle carrier
	424	drive-pin channel
	426	bearing bore
	428	guide channel
15	430	sliding block
	432	drive-pin bore
	500	toothbrush
	510	toothbrush body
20	512	toothbrush head
	514	drive pin
	516	bearing journal
	520	bristle carrier
	524	drive-pin channel
25	526	bearing bore
	528	guide channel
	530	sliding block
	532	drive-pin bore
30	600	toothbrush
	610	toothbrush body
	612	toothbrush head
	614	drive pin
	616	bearing journal
35	620	bristle carrier
	624	drive-pin channel
	626	bearing bore

628 guide channel
634 cavity

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WESTPHAL, MUSSGNUM & PARTER
November 26, 2001
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Amended Claims

1. Toothbrush with a toothbrush head (312; 412; 512; 612) supported by a toothbrush body (310; 410; 510; 610), the toothbrush head (312; 412; 512; 612) comprising:

- a bristle carrying bristle carrier (320; 420; 520; 620), the bristle carrier (20; 220; 320; 420; 520; 620) rotatably supported for rotating about a rotation axis and adapted to be reversibly rotatably driven by an eccentric drive (50, 52), wherein

- the eccentric drive has a drive shaft (50) rotating in one direction and arranged perpendicular to the rotation axis (R) of the bristle carrier (320; 420; 520; 620) and centrally extending through the toothbrush body (310; 410; 510; 610), with an end face of the drive shaft (50) having an eccentric pin (52), wherein

- the bristle carrier (320; 420; 520; 620) has a guide bore or a guide channel (328; 428; 528; 628) extending in the axial direction, with the eccentric pin (52) guided in the guide bore or guide channel,

characterized in

- that the bristle carrier (320; 420; 520; 620) is supported on the toothbrush head (312; 412; 512; 612) for movement in the axial direction and adapted to be reversibly driven by the eccentric drive (40, 50, 52) so as to move backward and forward along a linear path,

- that the bristle carrier (320; 420; 520; 620) has at least one drive pin channel (324; 424; 524; 624) which is disposed along a circumferential segment of the bristle carrier (320; 420; 520; 620) and inclined in the axial direction, and

- that the at least one drive pin (314; 414; 514; 614) which is guided in the drive pin channel (324; 424; 524; 624), is disposed on the toothbrush head (312; 412; 512; 614).

2. The toothbrush according to claim 1,
characterized in

- that the two diametrically opposed guide pins (314) are disposed on the toothbrush head (310).

3. The toothbrush according to claim 1 or 2,
characterized in that the guide channel (628) is formed directly on the bristle carrier (620).
4. The toothbrush according to claim 1 or 2,
characterized in that the guide channel is part of a sliding block which is axially affixed to the
bristle carrier.
5. The toothbrush according to claim 1 or 2,
characterized in
that a sliding block (330; 430; 530) is supported for axial displacement in the guide
channel (328; 428; 528), and
that sliding block (330; 430; 530) has a drive-pin bore (332; 432; 532) adapted to engage
with the eccentric pin (52).
6. The toothbrush according to claim 4 or 5,
characterized in that the sliding block (330; 430) has a cylindrical shape.
7. The toothbrush according to claim 4 or 5,
characterized in that the sliding block (530) has a spherical shape.

8. Toothbrush with a toothbrush head (12; 212) supported by a toothbrush body (10; 210), the toothbrush head (12; 212) comprising:

- a bristle carrying bristle carrier (20; 220), the bristle carrier (20; 220) rotatably supported for rotating about a rotation axis (R) and adapted to be reversibly rotatably driven by an eccentric drive (40, 50, 52), wherein
- the eccentric drive has a drive shaft (50) rotating in one direction and arranged perpendicular to the rotation axis (R) of the bristle carrier (20; 220) and centrally extending through the toothbrush body (10; 210), with an end face of the drive shaft (50) having an eccentric pin (52), wherein

the bristle carrier (20; 220) has a guide bore or a guide channel (28; 228) extending in the axial direction, with the eccentric pin (52) guided in the guide bore or guide channel, characterized in

that the bristle carrier (20; 220) is supported on the toothbrush head (12; 212) for movement in the axial direction and adapted to be reversibly driven by the eccentric drive (40, 50, 52) so as to move backward and forward along a linear path,

that the eccentric pin (52) engages in a drive-pin bore (32; 232) or a guide channel (28; 228), and is mounted axially fixed in the drive-pin bore (32; 232) or is axially moveable in the guide channel (28; 228) between limit stops.

9. The toothbrush according to claim 8, thereby characterized, that the toothbrush head (12; 212) has at least one bearing channel (14; 214) adapted to engage with at least one corresponding bearing projection (24; 224) which limits the backward and forward linear motion (stroke) of the bristle carrier (20; 220).

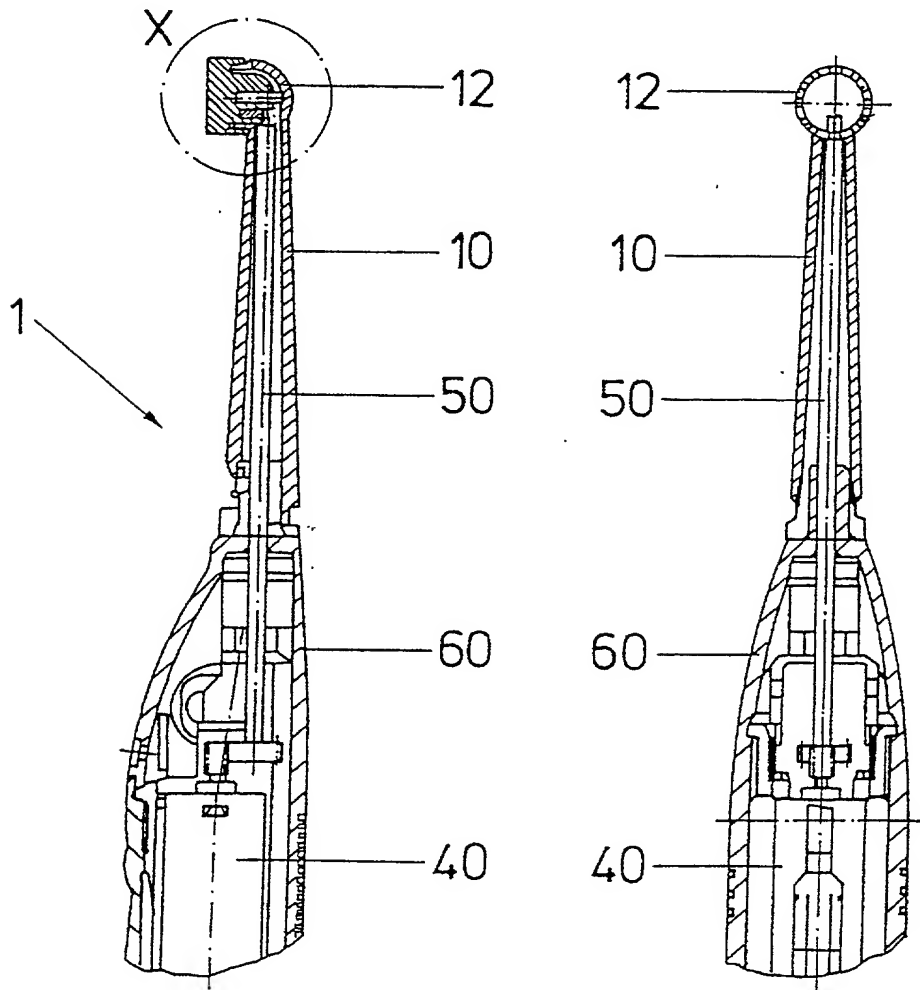
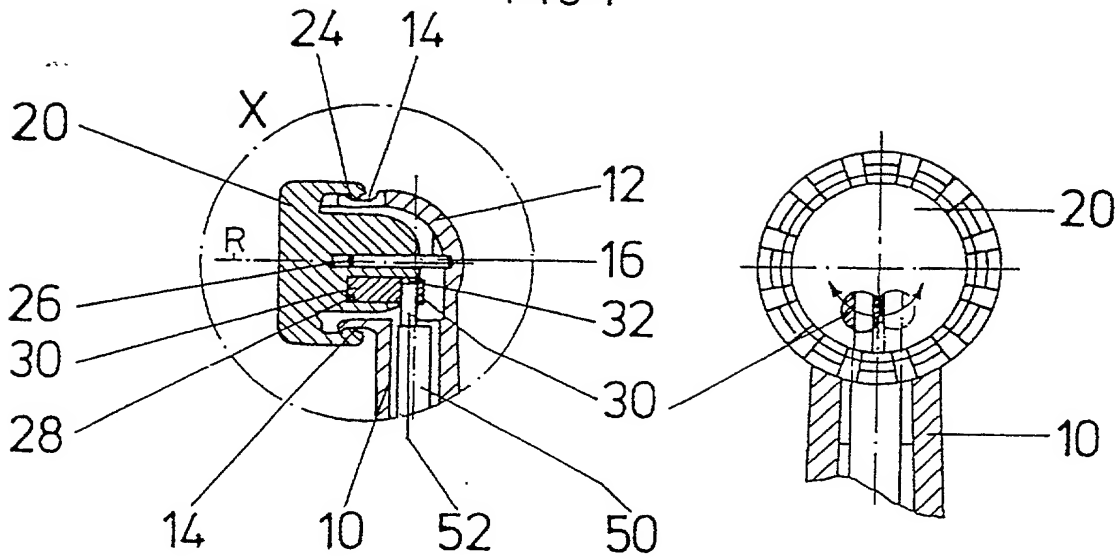
10. The toothbrush according to claim 8 or 9, characterized in

- that a sliding block (30; 230) is provided which includes a drive-pin bore (32; 232) or a guide channel adapted to engage with the eccentric pin (52), and
- that the sliding block (30; 230) is axially affixed in the guide channel (28; 228) or axially moveable therein between limit stops.

11. The toothbrush according to claim 10,
characterized in that the sliding block (130; 230; 330; 430) has a cylindrical shape.
12. The toothbrush according to claim 10,
characterized in that the sliding block (530) has a spherical shape.

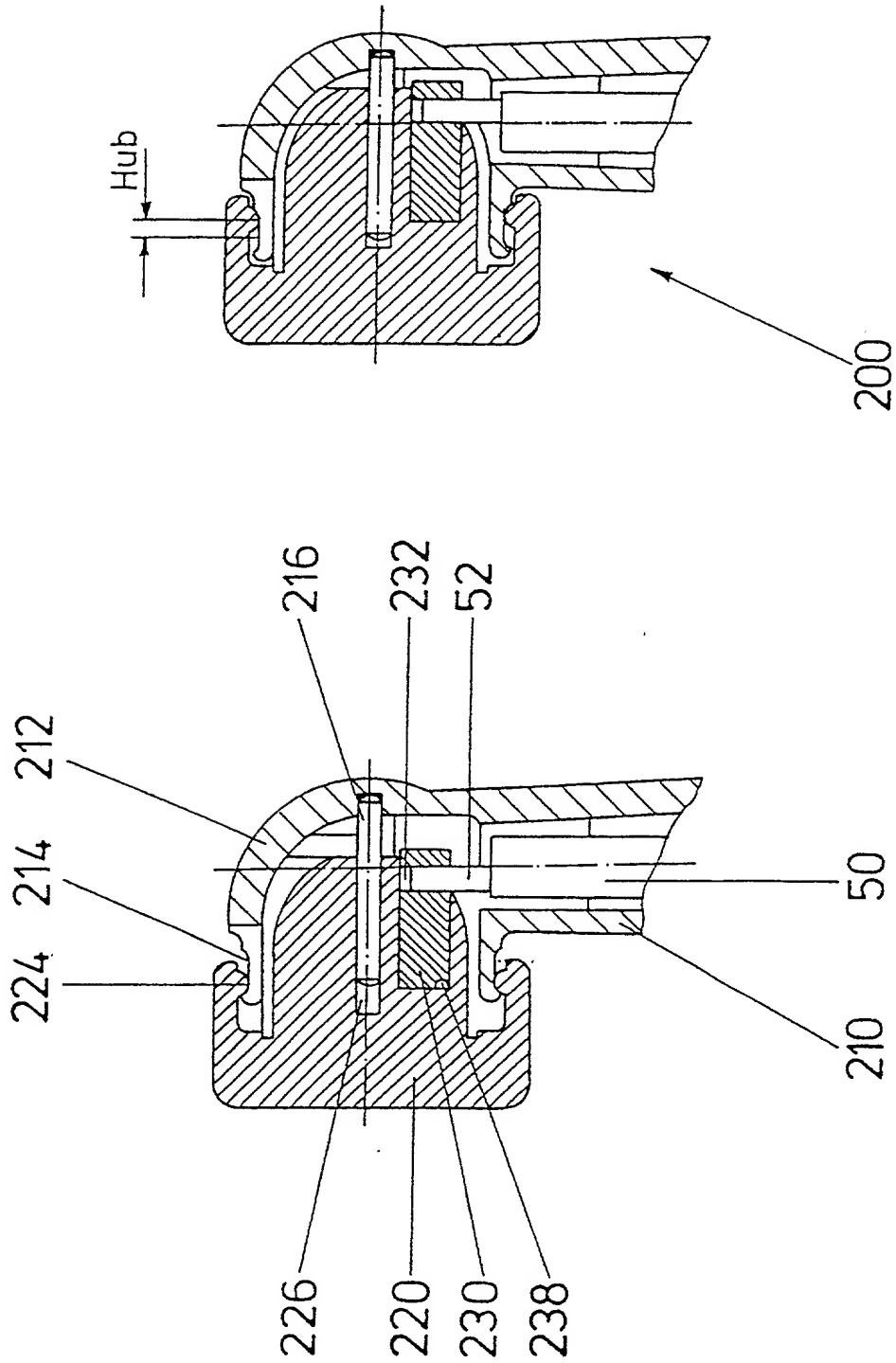
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FIG 1

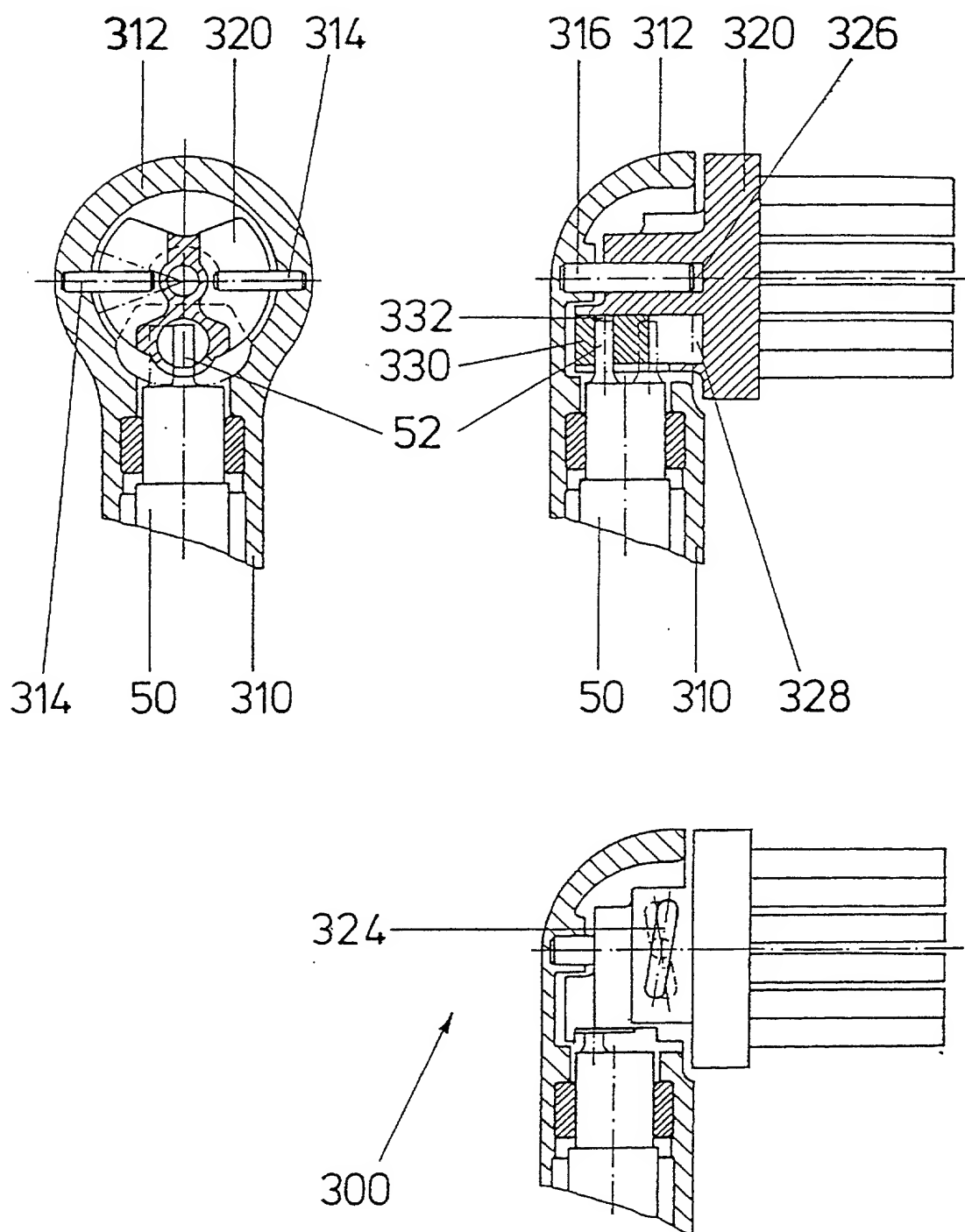


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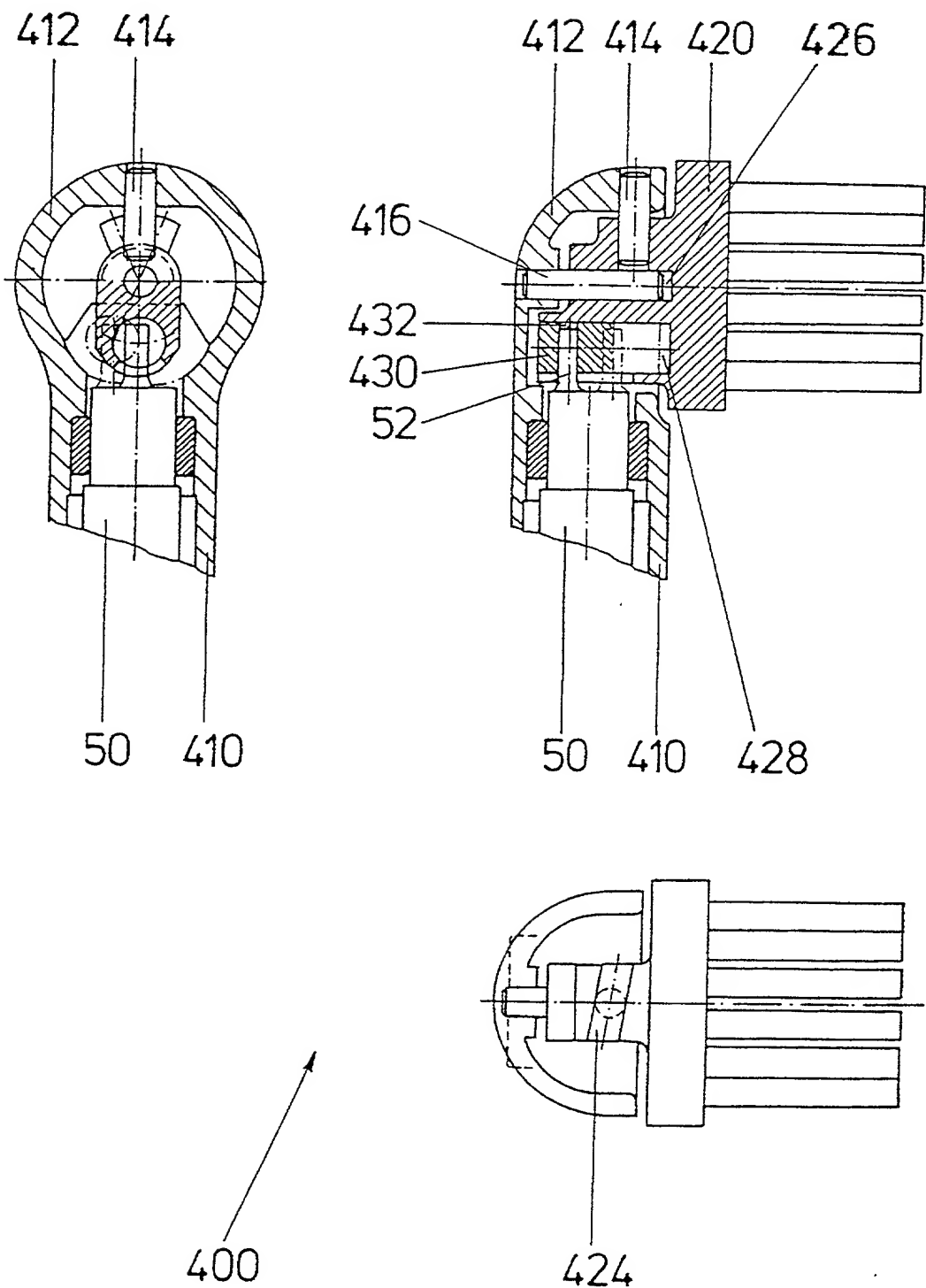
FIG 2



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FIG 3

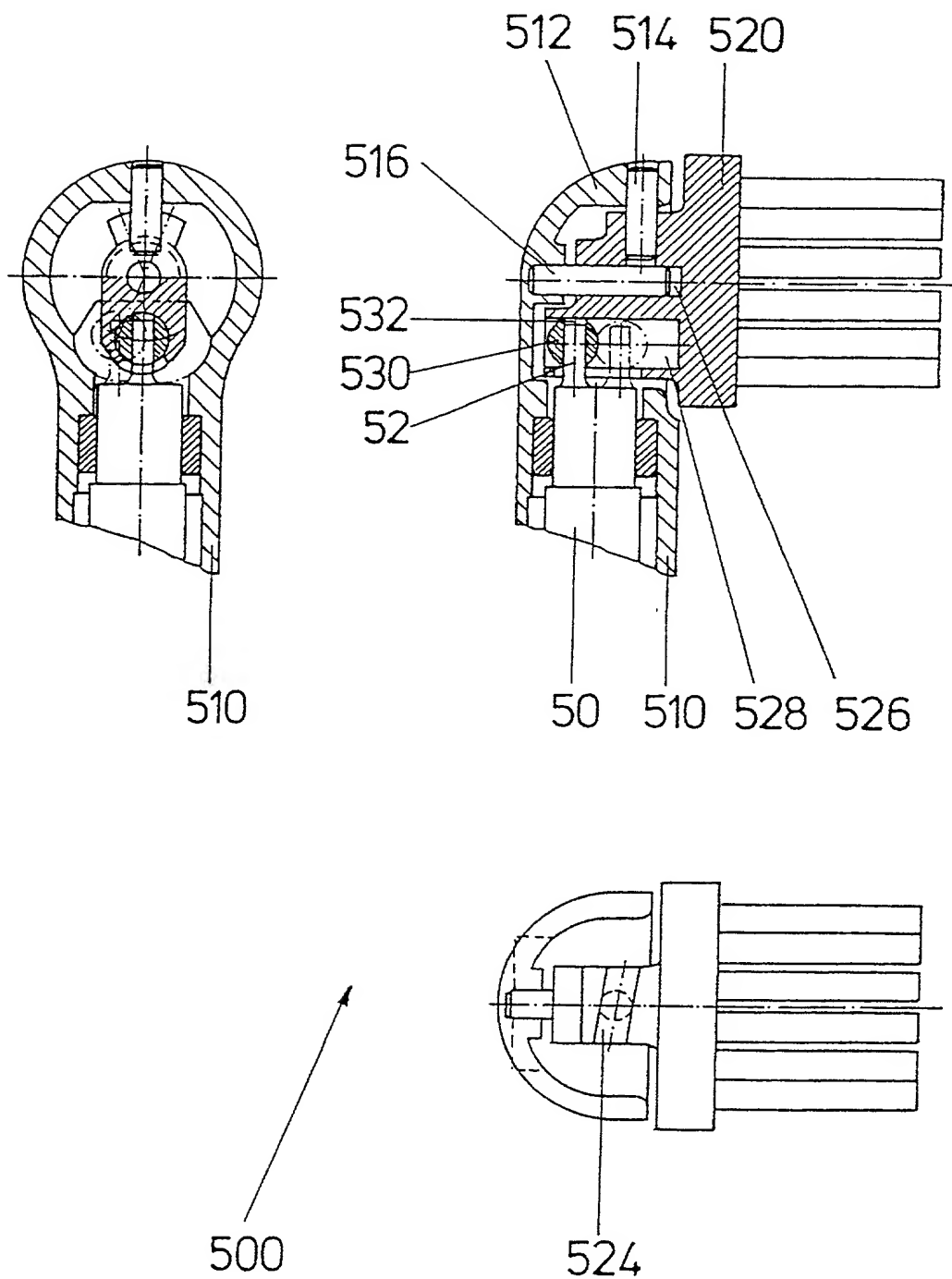


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FIG 4



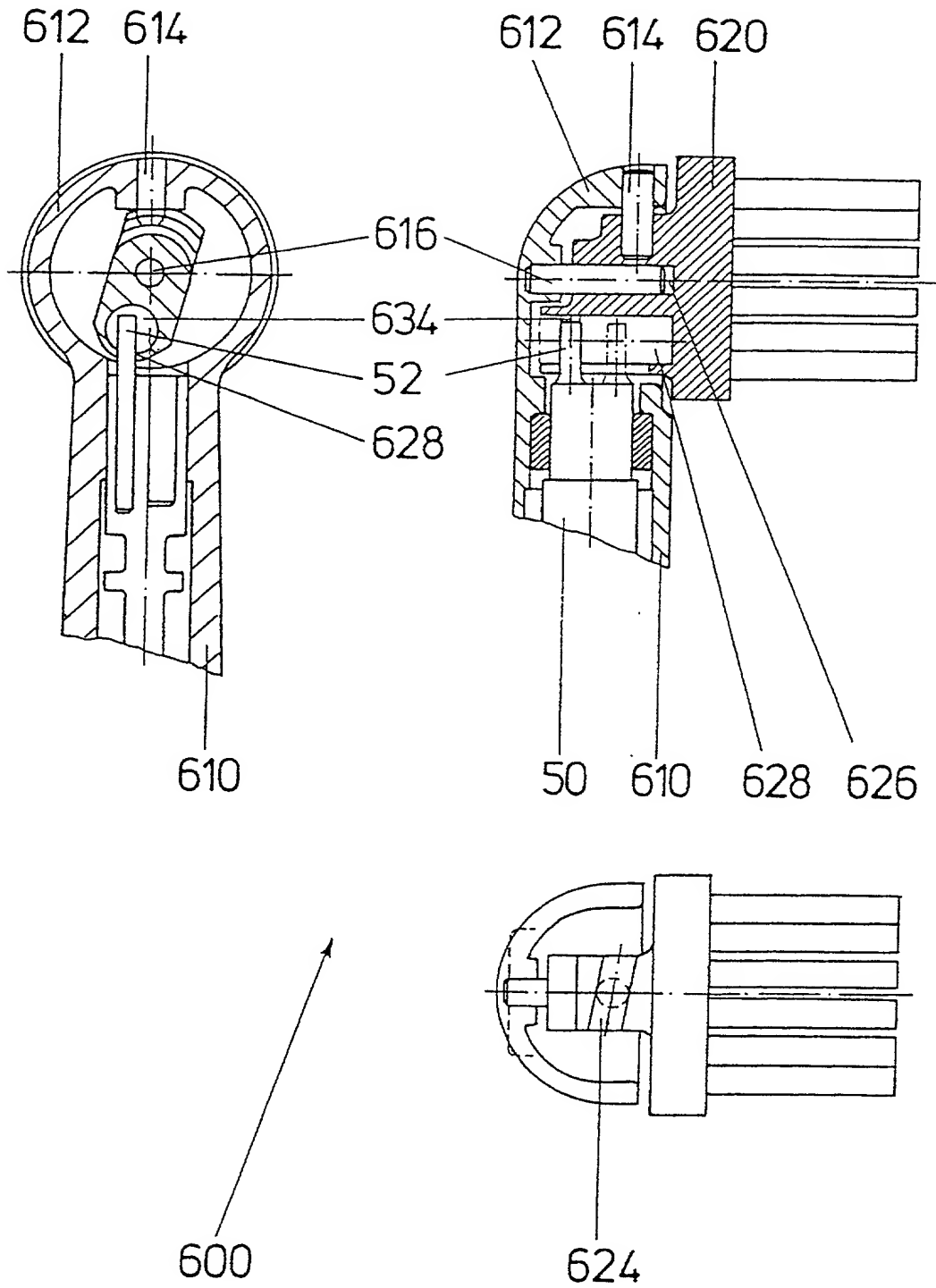
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FIG 5



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FIG 6



DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

mor 094 us

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **TOOTHBRUSH**

the specification of which (check one)

() is attached hereto.

(X) was filed on July 27, 2000 as PCT International Application Number PCT/EP00/07213.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulation, §1.56. I hereby claim foreign priority benefits under Title 35, United States Code, §119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate disclosing the subject matter claimed in their application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority is claimed, before the filing date of this application.

Prior foreign Application(s)

Number	Country	Day/Month/Year Filed	Priority Claimed
199 34 805.7	GERMANY	28/07/99	(X) Yes () No
			() Yes () No
			() Yes () No

I hereby claim the benefit under Title 35, United States Code, §120/365 of any United States application(s) listed below and PCT International Applications listed above or below, and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Number)	Day/Month/Year Filed	Status (Patented, Pending, Abandoned)

I hereby appoint Donald W. Muirhead, Reg. No. 33,978; Anne E. Saturnelli, Reg. No. 41,290; David Suhl, Reg. No. 43,169; and Robert V. Klauzinski, Reg. No. 42,742 as attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's signature Niebergall Date 08.01.02

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() Additional inventors are being named on separately numbered sheets attached hereto.